GEORGIA INSTITUTE OF TECHNOLOGY
Engineering Experiment Station

PROJECT INITIATION

Date: 3/2/71

Project Title: Development of Body Implant Products

Project No.: A-1314

Project Director: Dr. R. F. Hochman

Sponsor: Zimmer Manufacturing Company

Effective March 1, 1971 Estimated to run until: February 28, 1972

Type Agreement: Industrial Research Project Amount: $ 7,690.00

Reports: Quarterly

Contact Person: Mr. Vernon R. Scott
Research Services Director
Zimmer Manufacturing Company
727 North Detroit
Warsaw, Indiana 46580

Assigned to Chemical Sciences & Materials Division

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RA-62(12-66)

GEORGIA INSTITUTE OF TECHNOLOGY
Engineering Experiment Station

PROJECT TERMINATION

Date October 3, 1973

PROJECT TITLE: Development of Body Implant Products

PROJECT NO: A-1314

PROJECT DIRECTOR: Dr. R. F. Hochman

SPONSOR: Zimmer Manufacturing Company; Warsaw, Indiana

TERMINATION EFFECTIVE: ~~Immediately~~

CHARGES SHOULD CLEAR ACCOUNTING BY: ~~10-31-73~~

CONTRACT CLOSEOUT ITEMS REMAINING: Last Quarterly Report (if appropriate)
Final Invoice (w/Advance Payment Settlement as applicable)

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Form EES 402 (R10-62)

A-1314

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CHEMICAL ENGINEERING

January 18, 1973

Mr. Lyle Johnson
Director of Research
Zimmer Mfg.
727 N. Detroit Street
Warsaw, Indiana 46580

Re: Implant Material Project

Dear Lyle:

I am sorry it was not possible to make my planned visit on January 8th and 9th, however, I am sure you can understand since we had one of the most viscous ice storms that I can recall. We were without power until late Thursday night and the house temperature had dropped to around 42°, so for about four days it was just a matter of trying to keep warm and existing. I am calling Heinz Blessing this week to discuss the prospects for visiting here as well as to reschedule the meeting with you and him in Warsaw. Since I wasn't able to make the visit and give you a verbal report, I thought I would summarize what we have accomplished the last three months.

We have completed the initial testing and preparation of tensile specimens along the lines of the method developed by Morgan Research and Development Ltd. to demonstrate fiber strength and the effect of various adhesives in improving the overall tensile strength of the uniaxial aligned specimens.

A complete and separate report on the testing procedure and method will be supplied you in the near future including dimensional drawings of specimen preparation device and testing fixtures as well as the equations necessary to determine the effective strength.

Four sets of specimens were prepared as follows:

1) A set of control specimens made of untreated fibers and silastic,

2) A set of specimens in which the carbon fibers had been pretreated for five minutes in 2.5% NaOCl solution followed by washing in distilled water and drying,

3) Pretreatment of fibers in vinyl sylane for five minutes and drying in the air,

4) Pretreatment for 5 minutes in 15% acetic acid solution and dried.

It was obvious that the tensile strength of the composites made after the sylane treatment was better than those in the NaOCl solution or acetic acid. The sylane treatment shows an increase over control specimens of nearly 25%. Additional sets of specimens containing other sylane treatments will also be examined as well as additional sets of pretreated carbon fibers which have been heat activated.

Upon conclusion of the tensile testing a series of shear tests to give more pertinent data on the increase in strength characteristics will be performed. Specimen and test fixtures are presently nearing completion and initial test specimens for evaluation of preparation procedures and development of technique have been made.

At this point with your animal test data, it is now possible to get a good reading on the characterization of the materials to be prepared for use or implants plus a reading should be available on the extent of the patent limitations. Therefore at this time it is important that we have a discussion to consider the future status of the program.

Attached is an invoice for the regular patent retainer for the months of November and December. I included both months on the same invoice since none were submitted for November. In addition to that, I still do not have the payment of the August invoice and have attached an additional copy of that. This was the time when I switched from submitting them to Vernon Scott to you and there may have been some mix up. I would certainly appreciate it if you would put this through since I have a fair amount of personal time invested.

I am encouraged with results to date and feel that with a meeting we can evaluate the potential use of this material for Zimmer implants.

Best personal regards.

Very cordially yours,

Robert F. Hochman
Associate Director for Metallurgy

RFH:np
Attachments

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA, GEORGIA 30332

SCHOOL OF
CHEMICAL ENGINEERING

Mr. Heinz Blessing, Engineering Research
Zimmer Manufacturing Company
727 N. Detriot Street
Warsaw, Indiana 46580

Dear Heinz:

This letter will confirm our plans for a meeting here at Georgia Tech, May 3rd and 4th, and provide you with information on the present status of the program. We are presently putting together a thorough report to include test procedures as well as background on the various experiments which have been performed, the reasons for performing these experiments and the data and interpretation. To date, we have been basically using modorate strength graphit fibers provided gratus by Lockheed and some carbon fibers also by gratus from Kreha. Initially, when this program started, these fibers, in small quantities were running extremely high and the value of the gratus materials was in excess of $2,000. Fortunently the price has been steadly decreasing and now most of the average materials could be purchased for $75 to $100 a pound. A complete table of materials will be provided in the report.

Because of equipment cost and money limitations our silicone composites is rather crude. The major factor in my mind is producing a stronger and better composit before we try to attempt producing actual devices. We are completing the test procedures for comparison of strengths, but it is very important that we now develop a more careful and reproducable preparation of composit systems for use with higher strength fibers. In reviewing the program and what has been done to date, it's obvious as you will see, with the amount of funds that have been spent it has been essentially a minimal operation of preparing simulated devices, showing the possibility of the patent and testing. We will present you with the alternatives including basically what we think is a general program to produce materials in the next few years and what it will cost Zimmer individually or what will be the prospects of working the NSF or with Dow and the NSF.

To do this work it was also necessary to get additional silicone and epoxy, fortunately the contacts with DOW here in Atlanta and our previous connections with the Lockheed program we have a gallon of epoxy and sixteen pounds of additional silicone resins donated by DOW should be received in the very near future.

There is data available on silicone-glass fiber composites strengths to 45-50 cw psi: have been obtained, which is close to epoxy-glass fiber strengths. Actual data will be in the report. No open data is available on graphit-silicone materials although DOW has some. It must be understood that the major function of the binder, whether it be epoxy, silicone, or some other polymer, is to serve in capacity of making all the fibers work together as a single unit. Thus surface wetting and adhension characteristics of the binder is far more significant than its strength. I must reiterate that it is more important to have a good fiber to matrix bond than the strongest binder. This is the whole basis of the composite technology.

I hope a complete report in bound form will be ready for you prior to your visit. If there is some reason we should be running behind in the final copies, I'll certainly try to get draft copies to you so that you can be reviewing them before your visit.

Because we are deeply engaged in a number of other areas of interest, particularly ion implantation of nitrogen in titanium and the formation of titanium carbide on materials by ion implantation, very likely Vernon Scott and Dennis Bardos might also like to visit. So, in addition to Dane and yourself, discuss the possibilities of Dennis, Vernon and possibly Lyle coming along with you to discuss not only this program but other research areas that will be of interest to Zimmer.

Best personal regards.

Very cordially yours,

Robert F. Hochman, Metallurgist

RFH:hdr

CC: Lyle Johnson
Dane Miller
Vernon Scott
Dennis Bardos